



Minnesota Plant Press

Vol. 11:1 Newsletter Of The Minnesota Native Plant Society, Fall 1991

Upcoming Monthly Meetings

The Minnesota Native Plant Society holds monthly meetings from October through May, on the first Wednesday of each month, unless otherwise stated. Meetings are held in room 335 Borlaug Hall, St. Paul campus U of M. Meeting times: 7:30 - 9:00 PM.

- October - Seed Storage & Germination Tips - May Wright. Survey results, discussion of proposed committee structure, seed exchange.
- November - The Dynamic Prairie: Disturbance Leads to Diversity - Prof. Charles Umbamhower, St. Olaf College.
- December - The Minnesota Department of Agriculture Endangered Species Protection Program - Lisa Mueller.
- January - Conserving Grassland Biodiversity: Northern European and Midwestern Approaches - David Wedin. NOTE: This meeting is January 8th.
- February - Minnesota's Native Orchids - Dianne Plunkett.

Touches of Fall Color in the Wildflower Garden

May Wright

The splendid color in our native deciduous trees such as the maples, oaks, and linden, draw our attention at this time of year. Have you noticed that there is also rich color in the understory shrubs and vines in the wildflowers carpeting the forest floor? Here are a few plants that can be seen in a stroll through the woods or the woodland garden.

A vine that is often sold in the cities for home decoration is the bittersweet (*Celastrus scandens*). It's orange capsule opens to display crimson seeds. In your garden, put male and female plants close together to ensure pollination and seed set.

Another well-known vine is Virginia creeper (*Parthenocissus quinquefolia*). It's berries are dark blue, but it's leaves turn a rich red color. It spreads rapidly and must be trimmed back periodically to keep it from taking over.

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Fall Color continued on pg. 6

Editor's Note

Bob Jacobson

I'm sorry to report that Sarah Vest has decided not to work on the newsletter anymore. We should commend her for her assistance last year. She did an excellent job and was responsible for many of the improvements that were made in 1990-91. Thanks Sarah!

We still need newsletter articles. If you would like to submit an article for publication, please do so! Longer articles should be submitted on a 3 1/4 inch floppy disk, preferably Macintosh formatted, but I can translate DOS formatted disks too. Unformatted (text) files are the easiest to work with. I will type in shorter articles of one page or less myself. Illustrations, graphics, cartoons and even poetry are welcome as well. Articles can be sent to me at:

Bob Jacobson

Announcements

- **Membership Renewal** - It's time to renew your memberships. Dues have gone up slightly (the Board members have to pay for that trip to Jamaica somehow! Just kidding). There is a membership renewal form towards the end of the newsletter.
- **The Society is sorry to announce the passing of one of it's members; Horace F. Chamberlain, of LeSeur, MN.** Mr. Chamberlain was active not only in the MNPS, but was a member of the Minnesota Ornithologists Union, The Nature Conservancy, Minnesota Valley National Wildlife Refuge, and was a Master Gardener. He and his wife recently donated 240 acres of land on the Minnesota River in LeSeur county to the DNR, which was designated a Scientific & Natural Area.

A Message from the President, Sept. 1991

Don Knutson

As we begin our 10th anniversary year, we want to congratulate you all for building the Minnesota Native Plant Society from an idea into a vigorous professional society. For a decade our objective has been to become the champions of Minnesota's native plants and their advocates. You have each supported this goal through your membership, your attendance, and your contributions to the newsletter, the speaker program and, of course, the committee work. Thank you for a decade of devotion to plant conservation! To get a feeling for what you would like the second decade to be, we sent out a questionnaire this last spring (if you didn't get one, please write or call for one). Ms. Pat Ryan summarized your responses as follows:

- You listed your interests in native plants under headings: "hobby, gardening, education and professional."
- You like the newsletter, and thought it is generally well-done, with a good balance of topics.

- Newsletter topics you suggested included gardening with wildflowers, where to go to see native plants, garden tour schedules, directories of plant sources, lists of garden clubs, and scientific articles on native plants. Some of you would like these as permanent columns.
- You like the symposium and prefer the metro as a location.
- Your suggestions for our monthly meeting programs included plant propagation, gardening practices, ecosystem analysis, species diversity and plant/wildlife relationships (including insects).
- Many of you are willing to lead field trips, give talks at our monthly meetings, write articles for the newsletter, work on the newsletter, and work on our standing committees. You had many more ideas than we can mention here. Thank you! Keep them coming!

Overwhelmingly, you want a stronger, more active society and you are willing to be more active in it. Just good news, this is, for Minnesota's native plants! Now we need to focus on selecting our objectives. What is it that we want to get done? Our purposes, as set out in the By-Laws, are as follows:

1. Conservation of all native plants.
2. Continuing education of members in the plant sciences.
3. To educate the public on environmental protection of plant life.
4. To encourage research and publications on native plants.
5. To study legislation on Minnesota flora, vegetation and ecosystems.
6. The preservation of special plants, plant communities and scientific and natural areas.
7. To cooperate in programs concerned with the ecology of natural resources and scenic features.
8. To promote fellowship with all persons interested in native plants – through meetings, lectures, workshops and field trips.

Recall that currently our major activities are the monthly meetings (with speakers, the seed exchange, and the plant sale), the annual symposium, the summer field trips and the newsletter (The Plant Press).

To better serve these activities, the Board recently decided to reduce the number of committees to four, and to give each committee more defined responsibilities and greater authority. These committees and their areas of activity are listed below:

1. **PROGRAM COMMITTEE** - Responsible for the monthly programs, symposium, field trips, seed exchange and plant sale.
2. **PUBLICATIONS COMMITTEE** - Responsible for publishing and soliciting articles for the newsletter, printing brochures, posters, etc. Sending out written materials in response to public requests for information about native plants. Keeping a roster of members with addresses and phone numbers.
3. **EDUCATION & OUTREACH COMMITTEE** - Responsible for new memberships, answering inquiries about memberships. Promoting new member involvement in Society affairs and providing refreshments at our monthly meetings. Also involved in Society publicity, historian activities and outreach to schools.

4. **CONSERVATION COMMITTEE** - Responsible for representing our point of view to duly elected officials of government, for lobbying legislators, for liaison with other conservation groups.

It is the opinion of your Board of Directors that if these committees are well-staffed, they will provide the strength and dynamism needed to launch our Society in our second decade. Please tell us what you think. During a series of discussions this summer, the Board members considered a number of topics related to our Society. The following is a partial list of "should we's."

1. Should we liaison with other conservation groups such as The Nature Conservancy, the Midwest Wildflower Research Center, the Entomological Society and others?
2. Should we develop a list of our members who would like to volunteer to give talks and field trips to schools, garden clubs and others?
3. Should we promote volunteer work with nature centers if they need help identifying wild plants?
4. Should we help State Agencies such as the Department of Natural Resources (DNR), Department of Transportation (Mn/DOT) and private organizations like The Nature Conservancy, manage critical land areas? Many of the Mn/DOT areas are very small and may be ideal projects for our members throughout the state.
5. Should we have out-state chapters of the Minnesota Native Plant Society? The Board said 'no' for now.
6. Should we develop a photo-library of native plant pictures? Where would it be housed?
7. Should we develop wild plant "preservation gardens" in Minnesota?
8. Should we consider money raising projects (selling native plant stationery, for example)?
9. Should we think about paying for a phone and someone to answer it? How about a permanent P.O. Box for our mail?
10. Should we seek corporate sponsors?
11. Should we begin an awards program -- honoring those who have done good things for native plants -- schools, corporations, garden clubs and individuals.
12. Should we invite others into our Society? We appeal to gardeners, photographers, educators and plant professionals. Should we welcome those interested in native plants and medicine, cloth dye, wildlife, poetry, music, jewelry, and so on? How do we find them?

These, and other thoughtful ideas, need to be considered by us all, so that we shape our Society to reflect our goals and the aspirations of our members. Again, please let us know what's important to you. You can reach me at:

Don Knutson

Leave a message, I'll call back!

Welcome, again, to a new year of native plant activity!

The Wetland Conservation Act of 1991: A Brief Summary

Don Knutson

All of us in the Minnesota Native Plant Society will remember 1991 as the year of passage of this important act. Please take time to thank Senator Charles Davis and Representative Willard Munger, the sponsors.

This important legislation signals recognition of the importance of wetlands and their importance in conserving our water resources, maintaining and improving water quality, providing habitat for all organisms, reducing erosion run-off and stream sedimentation, and honoring the beauty of our Minnesota landscapes. Specific aspects of the new law include:

1. A requirement that state and local water plans identify high priority wetlands for preservation, enhancement, restoration and establishment.
2. That the Board of Water and Soil Resources, in consultation with the Commissioner of Natural Resources, adopt rules establishing criteria to determine the public value of wetlands.
3. Provides for compensation for landowners with Types 1,2, and 3 wetlands who apply to the Board of Water and Soil Resources. When the landowner gives a permanent easement, they will get a percent of the estimated market value for agricultural property within that county. In the metro area, landowners will get 50% of the market value of agricultural land and 20% for non-agricultural lands.
4. It includes provisions for the designation of wetland preservation areas, including the duration, procedures for early termination, limits on public projects and a tax exemption for land in wetland preservation areas.
5. Provides wetland establishment whereby a willing landowner may apply to have a wetland established or restored.
6. It defines regulations of wetland activities. Specifics are: calcareous fens may not be filled in, drained, or otherwise degraded unless under special approval of the Commissioner of Natural Resources. Other types of wetlands cannot be drained or filled unless replaced by restoring or creating wetlands of equal public value. Replacement is not required for wetlands that have been planted or harvested or that are under set-aside programs.
7. For the period between January 1, 1992 and July 1, 1993, state agencies or local units of government may not issue permits for draining, burning or filling a wetland, unless an exemption is provided.
8. The law details prohibited activities on ecologically significant peatlands and greatly restricts allowed activities.
9. It provides bonding authority and makes appropriations for conservation easements on wetlands and for restorations. A total of 13 million dollars in new and existing bonding is authorized along with 3 million dollars in general fund appropriations.

As copies of the law become available, we will want to read it to assure ourselves that Minnesota's native plants are included in these broad protective measures.

Fall Color, continued from pg. 1

There are many colorful shrubs. One of my favorites is the high-bush cranberry (*Viburnum trilobum*). It's bright red berries make delicious jelly and it's leaves set the whole bush ablaze with their intense red color. It grows along streams and also at the edges of woods.

The hazelnut (*Corylus americana*) is best known for it's edible seed. It is more somber than the high-bush cranberry, but is attractive when it's leaves take on a pinkish tinge. It too grows along the edges of woods.

Winterberry (*Ilex verticillata*) is a holly that grows wild in Minnesota in swamps or in moist soil, but it will still grow in any good garden soil. While the leaves are still green, it sets bright red berries all along the branches. These stay on the branch after the leaves have fallen - hence it's name - winterberry. It may grow to be quite tall. Both male and female plants are needed to ensure fruits.

Along the woodland paths one's attention may be drawn to the bellwort (*Uvularia grandiflora*) that often turns bright yellow early in the season while most other wildflowers are still green.

Another plant readily noticed is the blue cohosh (*Caulophyllum thalictroides*). It's intense blue seeds show above the divided leaves. It is a plant that needs little care and looks good all summer.

The baneberry (*Actea* sp.) fruits are also highly visible. As the common name implies, they are poisonous, so care should be taken if there are small children around. The species with the cherry-red fruits is *Actea rubra*. The true white species is *Actea pachypoda*, also known as doll's eyes. It has a large cluster of stark white berries each with a central black spot and a thick red stalk. The white form of *A. rubra* is not as clear a white and it's stalks are much thinner, almost thread-like. The white form of *A. rubra* is the most common one in this part of the state.

The twelve-inch leaves of the mayapple (*Podophyllum peltatum*) can't be readily overlooked. Nor can the egg-sized bright yellow fruit that hangs from the fork of the two large leaves. It is said to be edible when fully ripe, "sweetly mawkish and full of seeds", by one description. "Eaten by pigs and boys" was Dr. Asa Gray's comment. Look for it in late summer and early fall.

It is the large-flowered species of trillium (*Trillium grandiflorum*) that draws the most attention in the spring. However, in the fall, it's fruit is a drab brown, while our other species flaunt bright red, interestingly-shaped, capsules.

A sure sign of fall in the woods is the compact cluster of scarlet berries of the jack-in-the-pulpit (*Arisaema triphyllum*). The berries keep their bright color while still standing upright or even after falling to the forest floor.

The panicle of berries hanging from the end of an arched stem belong to the false Solomon's seal (*Smilacina racemosa*). In the group, you may find fruits of different shades as they turn from cream to pink to red-spotted, and finally a ruby-red.

In the true Solomon's seal (*Polygonatum biflorum*), the fruits are not at the end, but hang in twos or threes from the axils of the leaves along the arching stem. It's fruits are a dark blue.

Rosy twisted stalk (*Streptopus roseus*) is a smaller plant, but like the Solomon's seal, it's fruits also hang from the leaf axils, one or two from each. It differs in that it's fruits are a conspicuous cherry-red color.

The wild geranium is pretty well known. It is easy to grow and spreads readily. If conditions are right, it changes to an interesting pinkish shade before drying and fading.

So far, I have been dealing with plants of the deciduous woods. The north woods also display bright colors among it's ground flora. The star-flower (*Trientalis borealis*) often starts to turn early. Some leaves of the "star" turn white, while others are pink or still green.

The bluebead lily (*Clintonia borealis*) has basal leaves somewhat like the stemless ladyslipper. It displays large "beads" of deep blue at the top of its ten inch stalk.

Reds are seen here and there below the evergreen trees. One that makes a Christmas picture of reds and greens is the bunchberry (*Cornus canadensis*). What seemed to be in the spring to be the center of one flower, was really a group of flowers, surrounded by whitish bracts. Now the bunch of red berries among the green leaves is quite striking. Unfortunately, in gardens, berries may not be formed if the necessary pollinator is not present. It is probably a beetle.

Not as demanding is the partridgeberry (*Mitchella repens*). It is a dainty, small-leaved plant that slowly spreads into a patch over logs in the woods. The leaves are quite similar to those of the twinflower, but can be distinguished by their central white vein. The scarlet berries seen all over the patch are formed from each set of two flowers joined at the base, making one two-eyed berry. It is a pleasant surprise to see the berries still bright red when the snow melts (that is if the "partridges" haven't found them). They are used extensively in the Glory Bowls sold at Christmas time. They also do well with other small plants in the north-woods terrarium.

Some of this information might be useful when selecting plants for a woodland garden. Thus the seasons of interest could be extended.

Are You Really Buying Native Wildflowers?

Roy Robison, Landscape Alternatives, Inc.

People are interested in using native wildflowers in the landscape for many reasons, including: lower maintenance (less cutting, no special care needed), a more interesting display of unique plants (opportunity to have hardy plant species displayed throughout the year), and the reduction of using our limited resources (less watering, no fertilizing)

However, with the popularity of "wildflowers" everyone is trying to jump on the bandwagon and are using the term to describe a large variety of plant species. Before you purchase any "wildflowers", make sure that you know what you are buying. Listed below are some of the terms you might encounter:

Wildflowers - Is one of the most common terms used to describe a wide variety of plants. The term refers to plants that can grow without any special care. These plants may include plant species that were originally growing in an area or a introduced species. Some of these introduced "wildflower" species are aggressive and can displace native plant populations.

Native plants - Plants that grow without any care. The plant species can be native to a particular area, a state or even the country.

Naturalized plants - Plants that have escaped cultivation and have become established in the wild.

Annuals - Plants that grow, flower and complete their life cycle in 1 year.

Biennials - Plants that grow for 2 years before completing its life cycle.

Perennials - The foliage and leaves die back every winter, but its the root structure or the underground storage system that lives for many years.

Short-lived perennials - Plant species that may live for 2-3 years. Examples include Black-eyed Susan (*Rudbeckia hirta*) and Cardinal Flower (*Lobelia cardinalis*). These plants self-seed easily so the species can persist in an area.

Cultivated perennials - Exotic plant species that are used in landscapes because they have been bred or selected for improved colors, size, etc.

Weeds - Any plant growing where it doesn't belong. These plants are usually aggressive and difficult to remove.

The next time you look at a wildflower catalog or visit a nursery, don't be bashful about asking some questions about the plants or seeds. Most nursery owners, including myself, are proud of what they grow and offer to the public.

Native Plant Watch.....

Western Jacob's Ladder Search

Roger Lake

The Native Plant Society has helped organize and promote work days for Western Jacob's Ladder in 1989, 1990 and 1991. This year's trip was on July 13 and it involved 5 people from the Society, U.S. Forest Service, and the Minnesota DNR.

The object of our effort, *Polemonium occidentale* var. *lacustre*, is a midwestern variety of a western montane species. It is known to occur in three conifer swamps: two in St. Louis county, northeastern Minnesota, and one in Florence County, northeastern Wisconsin. The variety *lacustre* is listed under the federal Endangered Species Act as category 2, a candidate species for which additional information is needed on biological status and vulnerability.

On July 13, we first visited the Side Lake location of the plant, about 25 miles north of Hibbing. Of the three sites, Side Lake is the oldest (discovered in 1944, and relocated in 1988) and largest (10,000+ plants on about 200 acres). Northern white cedar is the dominant tree on this peatland, and *Polemonium* occurs in open, wet areas of the forest. The openness seems to be maintained by



Ellen Fager

Western Jacob's Ladder
Polemonium occidentale var. *lacustre*

wetness, although the hydrological regime is not well understood. There is a small permanent trout stream flowing out of the peatland. The stream's water is very clear, with a pH of about 7.5 and total alkalinity of about 120 ppm, indicating groundwater discharge.

The Side Lake peatland is fairly large (about 1 square mile) and has appreciable slope (about 20 feet/mile). It lies at the foot of an area of glacial moraine and sand plain, the probable source of groundwater.

During our walk in the Side Lake peatland, we discussed how the cedar forest seems to be influenced by the underlying peat and its geologic and hydrologic environment. But we also took plenty of time to view and photograph the numerous orchids also present in the area.

After lunch we went to the Lake Leander site about 13 miles to the east. *Polemonium* was found there in June 1991. The Leander peatland is similar in being large and situated at the lower slope of a moraine and elevated plain. The peatland at Leander also has appreciable slope, and there are small streams issuing from it.

Both the Side Lake and Leander sites were logged decades ago by the old time loggers. However, much of the Leander site was also logged about 2 years ago, offering good opportunity to observe effects of canopy removal. The area was logged for pulpwood in winter, with slash piled and burned. Trees were predominantly black spruce, though some cedar and tamarac were also cut.

Two small patches of *Polemonium* were known to be out in the clearcut, and Steve Wilson found 2 more on July 13. The patches are 2 to perhaps 20 yd² in area and contain several dozen to more than 100 plants each. The plants in the patches occur at high densities and are very vigorous, with more flowering plants than are seen in areas with even modest tree canopy.

We also looked at a large *Polemonium* patch of at least an acre which straddles the cut boundary. Black spruce trees in the large patch are appreciably smaller than those logged, and the canopy is somewhat open. Interestingly, the large patch was typed as being in a small lower-volume, lower-density "inclusion" during the forestry inventory of the area.

All this prompted much discussion of why *Polemonium* is found on these sites and has not been found yet in other peatlands in Minnesota. We also discussed the desirability of long-term monitoring of the populations and the environmental factors which seem to be affecting them. It is clear that a good design will be difficult to develop. There are the usual problems of an observational study instead of a true experiment. Also, the great variation in densities and highly clumped distribution of the plant will be hard to handle.

All in all, it was an interesting day, and we did not miss the rain which soaked things the morning of the 1990 *Polemonium* field trip.

The Field Trip to Weaver Bottoms - 3, August 1991

Don Knutson (a landlubber) & Ellen Fuge

It was a beautiful sunny day on the Old Zumbro River Channel. Eleven paddlers including the trip leaders Steve Eggers and Ellen Fuge, put in at the bridge on Co Rd 84 north of Weaver, MN. The group spotted wood ducks, egrets, great blue herons and little green herons. The wild rice, pickerel weed and arrow head were all in bloom. As we floated out of the river and into Weaver bottoms, a loose cluster of giant swallowtails greeted us. The high water levels into the growing season had reduced the size of the lotus stands in the lake and the spectacular show of two years ago was not there. But the few plants we did locate still flaunted their magnificent flowers.

Weaver Bottoms is a back water of the Mississippi River, formed by a dam, below Wabasha, Minnesota. We met at Weaver's Landing, and, after our fearless leaders determined the correct ratios of people, paddles and flotation devices, we arranged ourselves in the canoes. As we moved into the beautiful, still channel, Steve gave us each a copy of a plant key - with pictures - of coontail, pickerel weed (with its lovely purple/violet flower spike), the broad-leaved arrowhead (beautiful white flowers), duckweed, and the diminutive watermeal, *Wolffia columbiana* var. *karsten*, the world's smallest flowering plant (1.0 mm diameter).

While Steve and Ellen gave us learned talks, we water-proofed our lunch and did other survival things. Eventually we got a long way from the point of launch - I (Don) estimated it to be roughly 100 yards - when the captain called for lunch. We nosed the canoes into a tight, defensive circle and began tossing muffins between boats and within boats. A few were lost. Robin Fox ate the most!

Leaving the soft-stemmed bulrushes and giant bur-reed behind, we moved into the open water to enjoy the profusion of yellow and white water lilies and the spectacular lotus plants (*Nelumbo lutea*). The lotus has pale yellow flowers on stalks that reach about 1 foot out of the water. There were literally acres of them! Every canoe dispersed to its own version of paradise. I carefully guided ours over a stump which held us hostage for several minutes. Add to this the ducks, the frogs, the sea-gulls, the hills of distant trees, the fresh wind, and the fun of being on a field trip with kindred spirits, and you have an inkling of a wonderful water trip!

After surveying the lotus beds the group traveled to the Kellogg - Weaver Dunes Scientific and Natural Area for a hike through the dunes to see what might be flowering there. We did locate the rare Fame Flower (*Talinum rugospermum*) just as it opened in the late afternoon. The Regal Fritillary butterflies and some bright green tree frogs also added to a pleasant walk.

MNPS Board of Directors Fall 1991

President:
Don Knutson

Board Members:

Cole Burrell

Vice President:
Char Bezanson

Roy Robison

Bonnie Harper-Lore

Secretary:
Pat Ryan

Ellen Fuge

Treasurer:
Harriet Mason

Newsletter Editor:
Bob Jacobson

Currently, there are two vacant positions on the MNPS board of directors. If you are interested in serving as a board member, please contact Don Knutson.

Minnesota Native Plant Society Membership Registration Form

☐ Renewal ☐ New Member

Membership categories:

☐ Individual - \$10.00 ☐ Family - \$12.00
☐ Student - \$8.00
☐ Senior - \$8.00

Name _____ Phone _____

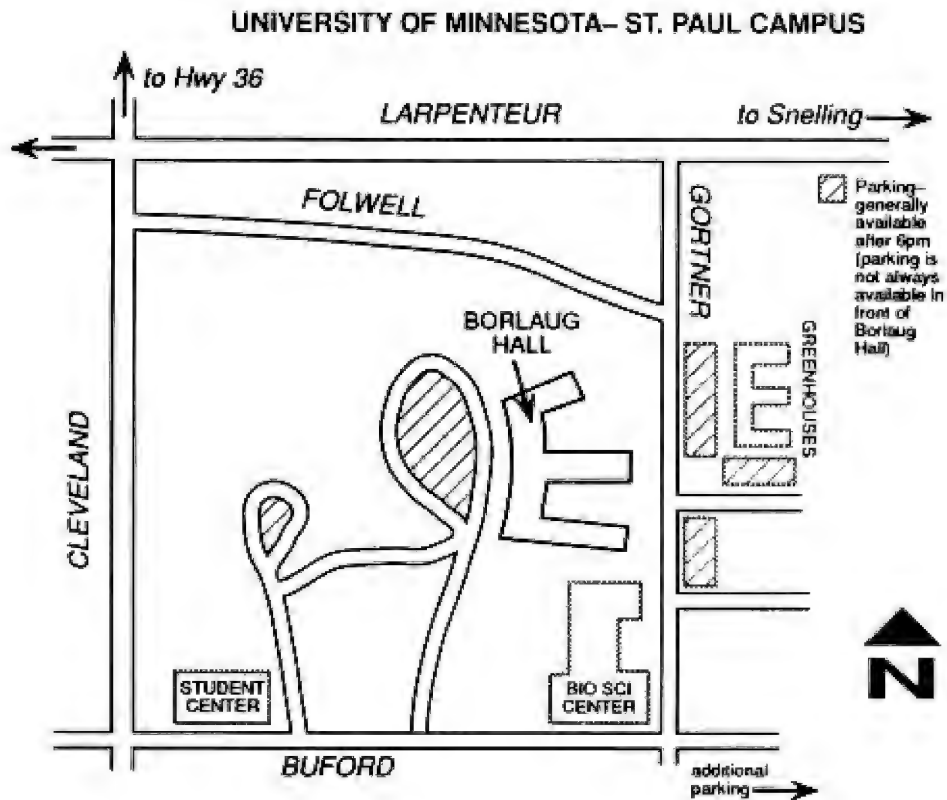
Address _____

City _____ State _____ Zip _____

Checks can be made out to the Minnesota Native Plant Society. Please fill out above form and mail with check to:

Minnesota Native Plant Society
220 Biological Sciences Center
University of Minnesota
St. Paul, MN 55108

Minnesota Native Plant Society



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Minnesota Plant Press

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Upcoming Monthly Meetings

The Minnesota Native Plant Society holds monthly meetings from October through May, on the first Wednesday of each month, unless otherwise stated. Meetings are held in room 335 Borlaug Hall, St. Paul campus U of M. Meeting times: 7:30 - 9:00 PM.

- February - Minnesota's Native Orchids - Dianne Plunkett, Nature Photographer.
- March - The Minnesota Scientific and Natural Areas Program - Bob Bjupstrum.
- April - Minnesota Mosses - Jan Jansson.
- May - Photo Contest Slide Show and Plant Sale.

The Amateur Botanist: Fun Projects for Kids of All Ages

Char A. Bezanson

The Amateur Botanist is a series of articles that will be appearing on a more-or-less regular basis in the Minnesota Plant Press. In these articles I will introduce natural history projects that can be used by adults (teachers, parents, friends or neighbors) to participate with young people in discovering the living world around them. These ideas, with appropriate modification, might form the basis for a school science project, a scout activity, or a family outing. I assume that adults will use discretion and provide guidance to young people when collecting materials outdoors, observing applicable regulations on private property and in parks. I welcome your suggestions and feedback.

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Forcing Branches

As trees and shrubs come out of dormancy in spring, sap begins to flow and buds begin to swell. To bring Spring on early, you can "force" twigs and branches into leaf or flower up to 6 weeks ahead of time. When cut, brought inside, and placed in water, twigs will continue to develop as they normally would, but faster. Because of the warmer temperature, branches will burst into leaf or flower in just a few weeks.

Forcing Branches continued on pg. 7

Editor's Note

Bob Jacobson

We still need newsletter articles. If you would like to submit an article for publication, please do so! Longer articles should be submitted on a 3 1/4 inch floppy disk, preferably Macintosh formatted, but I can translate DOS formatted disks too. Unformatted (text) files are the easiest to work with. I will type in shorter articles of one page or less myself. Illustrations, graphics, cartoons and even poetry are welcome as well. Articles can be sent to me at:

Bob Jacobson

Announcements

- **Membership Renewal** - In case you forgot, you can still renew your membership. There is a membership renewal form towards the end of the newsletter.
- **MNPS Annual Symposium** - The annual symposium will be held Saturday, April 11, 1992 from 9:00 AM - 2:00 PM at the Earle Brown Center on the University of Minnesota, St. Paul Campus. In this tenth year of our society, the symposium will examine the status of our rarest and most fragile native plants and their habitats, both in the wild and in our gardens. Topics to be discussed include:
 - The Minnesota landscape - an overview.
 - Sensitive and fragile Minnesota habitats, their status and prospects.
 - Politics and current legislative efforts on behalf of native plants.
 - Individual involvement in native plant preservation; such as gardening with rare plants, ethical issues in propagating and selling native plants, and individual restoration and conservation projects.

We will have displays by individuals and organizations, a coffee and snacks break, and time for lunch at the Student Center or elsewhere. The Earle Brown Center is conveniently located near parking and is quite comfortably furnished. The Student Center is two blocks away. Brochures with registration forms will be sent to all MNPS members, and will be available to non-members in various locations around the Twin Cities. Phone Ester McLaughlin for more information at

- **MNPS Education & Outreach Committee** - The Native Plant Societies' Education and Outreach Committee is now up and running with it's new chairperson, Diane Hilscher. This committee is responsible for new memberships and promoting new member involvement in the society. The committee members are involved in providing refreshments at monthly meetings (though any delectables you'd like to bring on your own to share would be warmly received). We also are involved in the Societies' publicity, historical activities and outreach to schools. Diane would welcome all efforts to help with any of these education and outreach activities. Do you know of any good publications to go into announcements in the newsletter or symposium? Diane will be talking with early members to learn more of the societies' history. Give Diane a call if you'd like to share some insights. Diane can be reached at _____ days and evenings.

- **Checklist of Common Plants Found In Itasca State Park** - This six page brochure by Anita F. Cholewa (UM Herbarium) and Gerald B. Ownbey (UM Prof. Emeritus) is available through the MNPS or from the DNR. The checklist lists the common plants found within the park by scientific and common name based on the habitat-type they are found in.
- **Minnesota Native Plant Society Plant-of-the-Month** - The Plant-of-the-month is a new feature of monthly plant society meetings instituted at the suggestion of members. The purpose is to increase the recognition and appreciation of specific native and naturalized plants. Members are encouraged to volunteer to present a Plant of the Month at a monthly meeting. In order to volunteer, contact a Program Committee member (1991-92: Char Bezanson, or at meetings) and get on the schedule. Selected plants may be significant because of their rarity, beauty, medicinal qualities, botanical or historical interest, cultural characteristics, or ubiquity: anything that makes the plant interesting to you. Presentations should be 5-10 minutes long and will be made immediately before the scheduled speaker during monthly meetings. They might include some or all of the following:
 - photographs or slides of the plant
 - live or pressed specimens
 - natural history of the plant
 - native habitat
 - horticultural uses; propagation
 - medicinal or historical uses
 Brush up on your botanical trivia and think about presenting your favorite native plant soon!
- **Suburban Prairies** - An informal, half day, meeting for all interested in the greater metro area prairies will be held Friday, March 20th, 1992 from 1:00-5:00 PM in the refuge, Hodson Hall, St. Paul Campus of the U of M. Sites include Parks, SNAs, Nature Centers and other areas with prairie plants. Undisturbed, restored and reconstructed prairies are included. For more information call or write: Dr. Catherine Reed, Entomology Dept. Rm 219 Hodson Hall, University of Minnesota, St. Paul, MN 55108. Phone:
- **Landscape Design Series** - This is a course being offered in the spring on creating your own landscape plan for the home. It is being offered by Diane Hilscher and Christine McGinnis, both professional landscape architects. There is a course fee and class size is limited. For more information call Diane Hilscher at

Summary of Guest Presentations at the MNPS General Meetings

November - Our speaker in November was Charles Umbanhowar, an Assistant Professor of Biology at St. Olaf College. Charles spoke about the impacts of disturbance and patch formation on the composition of prairies, based on examples from his dissertation research at the Nature Conservancy's S.H. Ordway Memorial Prairie in northcentral South Dakota. Charles began by talking about the diversity of native prairie and how as many as 20-30 or more plant species can be found in an area of one square yard.

Ant mounds, badger mounds, bison wallows (circular depressions created by rolling bison), and dry prairie marshes are some of the common types of patches (openings of bare soil) found in prairie and are probably important in maintaining species diversity in prairies. Ant and earthen mounds are smaller but generally more abundant than wallows and dry prairie marshes.

Ant mounds are dominated by perennial, vegetatively reproducing grasses, while earthen mounds tend to be dominated both by perennial vegetatively reproducing forbs and, to a much lesser extent, grasses. Bison wallows and dry prairie marshes are dominated by annuals and, in contrast to the mounds, many of the species found in wallows and dry prairie marshes are not found in the area around patches. Charles concluded by noting that a lack of good records makes it difficult to discuss the historical importance of patches and other disturbances in prairie, or their use in managing prairies today.

Charles majored in biology at Carleton College and graduated in 1985. He was a graduate student in the Department of Botany at the University of Wisconsin-Madison and completed his Ph.D. in 1989 under the supervision of Ed Beals. He spent a year with the ND Natural Heritage Inventory in Bismarck, ND and is currently teaching at St. Olaf College. His research interests are diverse and have included prairie and oak savanna restoration, the biology of *Platanthera praeclara* (the western prairie fringed orchid), re-analysis of the Wisconsin prairie continuum and computerization of the data that form the basis for Curtis' Vegetation of Wisconsin.

December - Plant-of-the-Month: Bonnie Harper-Lore. Bonnie described the native prairie plant, *Liatris pycnostachya* (blazing star). She also related the interesting story of how an enterprising student of horticulture in Minnesota smuggled this plant into Israel where it is now grown as a popular flower of the florists trade. Others in the MNPS audience commented on how sensitive *Liatris* is to rain-borne herbicides and that it is most attractive to Monarch butterflies and therefore a prime choice for a butterfly garden plant.

The main speaker of the evening was Dr. Dave Wedin who titled his talk "Conserving Grassland Biological Diversity: Reflections from Europe and the Midwest". He related his experiences from a European conference on grassland management and conservation where two stereotypes were shattered; 1) that all grasslands in Europe are managed and anthropogenically established, and 2) that there is an equilibrium between plant communities and civilization in Europe.

Dr. Wedin believes that the loss of biodiversity is just as great in Europe as it is here. Conservationists in Europe are struggling to maintain small remnants of natural communities just as we are in the Midwest. He listed three main questions to be addressed when considering the differences between the existing remnants and the "ancient" or "original" communities on both continents; 1) Why the ecological system or vegetative community faces threats, 2) What does research show maintained these communities, and 3) How can we restore the community?

Four European remnant vegetative communities were used as examples to explore the application of these questions. The Holland hay meadow, an ancient grassland type was established and maintained by archaic agricultural methods. This community was adapted to unique human disturbance and the integrity of its animal and plant populations is threatened since the abandonment of these practices.

The chalk grassland community was maintained by sheep grazing and seed dispersal for a millennium. There were several causes for the demise of these grasslands of low productivity. In the 1870's sheep raising declined. The lands were converted to crops around 1910-20. The post-WWII use of chemical fertilizers contributed to the intense eutrophication of these areas. The previous use of chemicals has made recovery of these lands difficult.

Eutrophication of grasslands played a role in the loss of the forb component in the wet meadow community type. Originally hayed and grazed, they were species rich. The application of high levels of chemical fertilizers has resulted in serious environmental consequences including the pollution of ground water. Scottish Highland cattle, the modern analogue of the ancient dairy

cattle which originally grazed and maintained these areas, have been introduced to reestablish the disturbance regime required by this grassland community.

The ancient practice of harvesting sod created and maintained the unique vegetative communities called heathlands. Loss of this practice has resulted in the degradation of these communities by the encroachment of woody species.

The problems faced by these plant communities in Europe are not that different from those of the Midwest's Tallgrass Prairie. What remains are small patches of an ancient ecosystem. Degradation is due to chemical agricultural practices and major changes in basic ecosystem functions such as hydrology and nutrient cycling.

Dr. Wedin concluded that we cannot protect these remnants simply by putting up a fence. The changes in the environment must be addressed. Restoration of ancient regimes or mechanisms may not be enough or the right answer to protecting and restoring these communities. In Europe, it is recognized that what goes on in agriculture will determine what happens to the remnant grasslands. There they are simultaneously addressing the questions of agricultural productivity and the need to preserve the habitat of rare species. This is not the case here, according to Dr. Wedin, where sustainable agriculture researchers and conservationists are not working together.

January - Plant-of-the-Month: Clarence Lehman. This year's first Plant-of-the-Month was *Aesclepias incarnata* (swamp or marsh milkweed). Clarence gave a delightful review of this plant's habitat, phenology and attributes. It's fragrance reminds Clarence of vanilla popcorn balls (and he likes the name "marsh" rather than "swamp" milkweed because it reminds him of marshmallows). Yum! (Actually the young pods and leaves of some milkweeds can be eaten after the bitter stomach cramping latex is leached out. They don't taste like popcorn balls or marshmallows, though. E.F. note) A good explanation of this plant's unique pollination mechanism was presented accompanied by helpful illustrations. Those clever plants!

The evenings' main presentation was given by Lisa Mueller from the Minnesota Department of Agriculture's (MDA) Endangered Species Program. It is Lisa's job to work with public agencies and private land owners to develop management plans and strategies that will serve to protect Federally listed plants and animals from pesticide application damage or destruction.

Lisa's presentation, entitled "Endangered Resources: Our Challenge for the Future" addressed the status, threats and protection efforts for Federally listed plants and animals in Minnesota. After an introduction about the number of plants, animals and invertebrates threatened around the world, the worldwide increased rate of extinction and the importance of biological diversity, the talk focused on Minnesota's rare and endangered species. A species threatened with extinction throughout all or a significant portion of its range is categorized as Endangered. A species is listed as Threatened if it is likely to become endangered in the foreseeable future throughout all or a significant portion of its range.

There are ten Federally listed species in Minnesota, four plants, two clams, three birds and one mammal. The official status of *Lespedeza leptostachya* (prairie bush clover) is State Endangered and Federally Threatened. It is found in seven Minnesota counties and only in four Midwestern states. *Platanthera praeclara* (western prairie fringed orchid) is also State Endangered and Federally Threatened. It is found in nine Minnesota counties and seven states. The largest population in the world is in the Red River Valley of the northwest part of our state. A very special plant is *Erythronium propullans* (dwarf trout lily). It is endemic to Minnesota (it doesn't exist anywhere else in the world!) and is only found in two counties at that! It's not too surprising

that it's State and Federally Endangered. A newly Federally listed plant is *Sedum integrifolium* (Leedy's roseroot). This State Endangered plant is found in two of Minnesota's SE counties. The only other locations for this plant are in New York state.

The three birds that are Federally listed and found in Minnesota are the Piping Plover (State and Federally Endangered), the peregrine falcon (State and Federally Endangered) and the bald eagle (State Threatened and Federally Endangered). Loss of habitat and the detrimental effects of pesticides (esp. DDT) have caused serious declines in these species both in and outside of the United states. The winged maple leaf mussel and Higgins eye pearly mussel are the Federally listed clam species found in Minnesota rivers. Dams that alter river dynamics, urban and agricultural runoff degrading water quality and the negative impact of exotic species such as the zebra mussel have contributed to the decline of these and other mollusks. It is important to note that it is illegal to collect living or dead shells of any mussel from the St. Croix or Namekagon Rivers in Minnesota and Wisconsin.

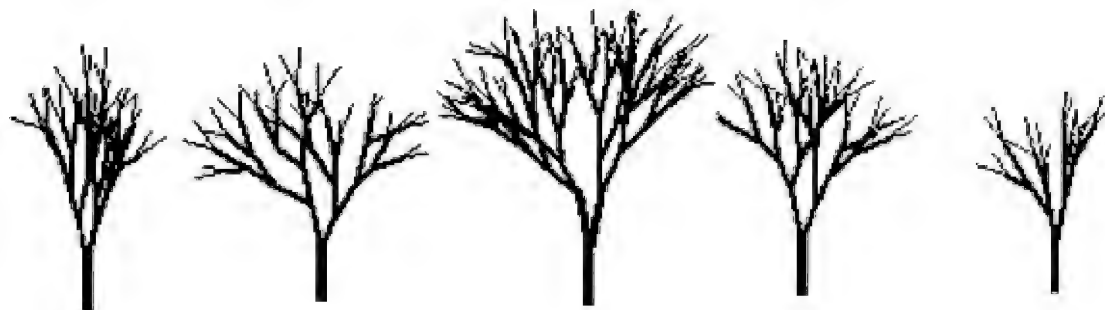
The State and Federally Threatened status of the timber wolf in Minnesota is a controversial issue. This mammal is Federally Endangered in the other 47 of the lower 48 states. There are estimated to be 1750 individuals in Minnesota ranking second to the greater populations in Alaska. Lisa noted that the number of Federally listed species grows every year. It is now recognized that protection at an ecosystem level will be more effective than continuing to focus at the species level which is in effect addressing the symptoms rather than the causes of extinction.

The conclusion of Lisa's beautifully illustrated presentation briefly described the way Minnesota's Endangered Species Program works with landowners to develop and implement pesticide management plans for specific sites, buffering and protecting the rare plants and animals that live here. She emphasized that these are voluntary protection agreements. The understanding and cooperation of individuals has led to 18 signed agreements of the 125 private landowners who have lands which support Federally listed species.

February - Plant-of-the-Month: by Welby Smith. Our main speaker will be Dianne Plunkett. She will speak on Minnesota's native orchids. Dianne has photographed 36 of Minnesota's 43 native orchids. She will speak on where to observe them, how to photograph them, where to purchase them and how to cultivate the more tolerant varieties. Her photographs which were taken throughout the Great Lakes region include flowers, buds, foliage and seed pods.

Dianne is the former president of the Minnesota Nature Photography Club, was the first Chair of the Minnesota International Exhibition of Botanical Photography whose slides are exhibited in the Nature Division of the Photographic Society of America. Professionally, Dianne is an attorney specializing in intellectual property and computer law.

Editors Note: Thank you Char Bezanson and Ellen Fuge for putting together these summaries.



The procedure for forcing branches is simple. About 6 weeks before the tree or shrub would normally flower, cut a 12- to 24- inch section of branch. For early-flowering shrubs and trees, the time to do this would be in late January or early February; later-flowering shrubs and trees should be cut in late February or March. For immediate forcing, scrape with a knife or scissors along a 3-inch length of bark at the bottom of the cutting and place in lukewarm water for a day. Then move the cutting to a container of cool water and place it at cool room temperature in indirect light. Mist with water several times a week if the room air is dry. Change the water and cut an inch or so from the end of the stems each week, if you can. Once the buds open, move the cuttings to a sunny location for good leaf color.

You might have a number of objectives in mind when forcing branches. If you are mainly interested in bringing Springtime inside a bit early, you may want to force showy early-flowering cultivated shrubs such as azalea, forsythia, mulberry, flowering almond, or redbud; these shrubs flower before the leaves emerge. Many native shrubs and trees also flower early, and can be cut in February: Juneberry (*Amelanchier* sp.), birches, hazelnut, elms, maples, plums, ashes, sumac, and of course pussy willows. Apples, crabapples, cherries, elderberry, mountain ash, honeylocust, and even buckthorn (if you haven't ripped this noxious invader out already!) can be cut a bit later.

Part of the fun, whether you know what a branch is or not, is to study each twig in some detail. If you have a copy of a winter twig key, you can identify the twigs, using a hand lens and the twig's characteristics including leaf scars, bud scales, leaf (scar) arrangement, bark, etc. If you've never taken the time to look closely at a twig before, you'll be amazed at the differences between them. You might notice that buds are always found above a leaf scar, and you can check your houseplants to see if buds, flowers and branches are always found in the axils of leaves. You can also tell how old a twig is by counting the scars of the overwintering bud formed each autumn. A winter key will have illustrations of these twig characteristics, and others.

Watching the twigs develop and seeing leaves and flowers emerge is also amazing. Many children are not even aware that trees flower- they've just never thought about it. (Children with pollen allergies may be the exception here!) Twigs and buds can be dissected using a hatpin and a single-edged razor blade or an Exacto knife. How do buds from different kinds of twigs differ? How do buds on the same twig differ? Can you tell which will produce leaves and which flowers? You can also perform experiments with your twigs: try placing containers of twigs at different temperatures, or under different light conditions. Do you have to use the same kind of twigs for this experiment? Why or why not?

A tree limb which has fallen in a winter storm or winter prunings from fruit trees can be forced even if the branch is cut too early, as long as the branch is kept alive and in a dormant

condition. One way to keep branches alive and dormant is to wrap them in moist burlap or newspaper and put them in an unheated garage or under a pile of snow. Another is to put the end of the branch or tree limb in a wastebasket or box of moist sand, again placing the branch in a sheltered place; the main requirement is that the branch be kept cold, moist, and protected from drying winds. Then you can bring the branch inside and force it in February or March. Forcing branches is a good way to study trees and shrubs while you are anxiously awaiting warmer weather. Once you have studied the details of twigs inside, you will begin to notice them on walks outside as well. Extending the appreciation of trees and shrubs to the winter months is fun, and a natural for those of us who live in the north!

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- Morley, Thomas. 1975. Deciduous Trees of Minnesota: a Winter Key. Department of Botany, University of Minnesota, St. Paul, MN.
- Watts, M.T. and Watts, T. 1970. Winter Tree Finder. Berkeley, CA, Nature Study Guild.

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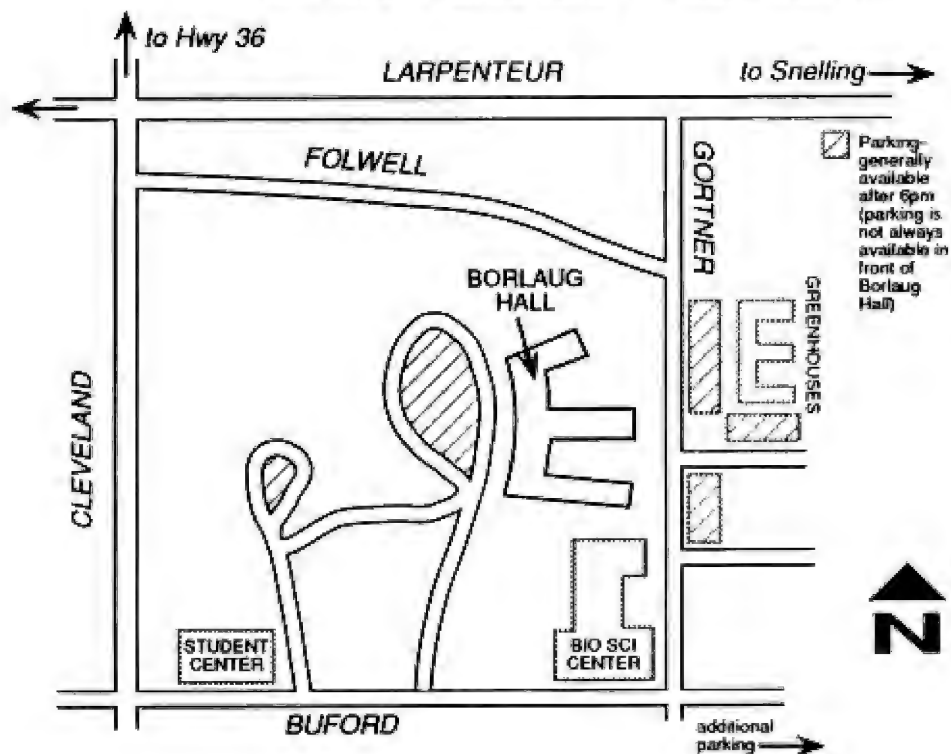
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Minnesota Plant Press

Vol. 11:3 Newsletter Of The Minnesota Native Plant Society, Spring 1992

Upcoming Monthly Meetings

May 6 - North American Chestnut Breeding Program; Dr. Lawrence Inman & Seed/seedling exchange

Wildflower Habitats and Microhabitats

May Wright

Just where should I put this plant? This question often arises when considering planting a native wildflower in a wildflower garden or restoration area. Among gardeners there is a common saying as follows: "If you have three specimens of the same species, plant two where you think they will do well. Plant the third where you know it will have difficulty surviving. The latter will probably be the one to succeed." To refute this pessimistic outlook, here are a few suggestions.

- 1) Remember that plants in the general garden trade were picked originally, and continuously selected, for their ease of culture. Therefore, wildflowers are more likely to have special requirements than common garden plants.
- 2) Think in terms of individual species, not the general group or genus. Because many violets grow in the woods does not mean that the Bird's-foot violet, *Viola pedata*, will do well there. It requires a sunnier spot with sandier soil. Many new wildflower gardeners have tried putting the various lady's-slippers all in the same general area and wondered why they didn't flourish. Some of these species have quite diverse needs. The stemless lady's-slipper, *Cypripedium acaule*, has to have a highly acid soil, whereas, the small white lady's-slipper, *Cypripedium candidum*, grows in calcareous (limey) soils.
- 3) Obtain information available from local growers - not just sellers. Their catalogues are very helpful. Books on wildflower culture are good references if they are for this general region. Those for the far south or west may not apply as directly.
- 4) Pertinent information may be obtained not only from books about wildflower culture, but also from ones that tell where the plant grows naturally. Northland Wildflowers by John Moyle and Evelyn Moyle includes many Minnesota summer-flowering species. Spring Flora of Minnesota by Thomas Morley deals with the spring-flowering ones.

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Announcements

• **MNPS Banquet** - On Friday evening, 10 April, 1992, about 35 members of the Minnesota Native Plant Society met on the high bluffs above the Mississippi River to celebrate the 10th anniversary of the Society. It was a jolly party! We met at the Emporium of Jazz in Mendota Heights and dined on Cajun food, Walleye Pike and delicious fresh bread along with tasty wine and beer. During ice cream and coffee, President Don Knutson gave a brief welcome after which Bonnie Harper-Lore opened the program. The first part was a series of verbal snapshots about the Society. Harriet Mason gave a synopsis of the LAWSUIT, concerning the dwarf trout lilies at Naerstrand Wood. Many of us were glad to get the details of this event, which happened before we were members of the Society.

Ruth Phipps told us of her early interest in native plants, but lack of specific information about them. She saw a newspaper article about May Wright and her garden, so she called May, and through this contact soon was a member—and a very active one—of the Society.

Chris Souter then told us of the early days of the Society—the months before, during and after the Michigan Botany Group started meeting. Peg Kohring was a very prominent member of this group who decided Minnesota needed a group similar to the one they had worked on in Michigan. Chris also listed the people who signed the articles of incorporation, and the members of the first Board of Directors. Diane Plunkett and Professor Ownbey added other details. Truly, our first 10 years were a colorful period! During these years, issues about native plants were being raised. Positions were defined. Advocacy became established. As a footnote, Chris Souter announced that Peg Kohring, serving with the Nature Conservancy in Guatemala, is beginning a native plant society there. Peg, we're all very proud of you!

The second part of the program was devoted to honoring several members of the Society who are distinguished by their devotion to native plants. To May Wright went the Showy Lady Slipper Award for Outstanding Commitment to Native Plants. Ruth Phipps received the Wild Rose award for Surpassing Dedication to Native Plant Gardening. Gerald Ownbey and Tom Morley were presented the Pasque Flower Award for Excellence in Education for their Atlas of Minnesota Plants. Don Lawrence, for his dedicated work in establishing the Allison Savanna and the Cedar Creek Natural Area, received the Allison Savanna Award for Stewardship of Nature.

Char Bezanson raffled off the *Dianthus* plants that adorned our tables just as the Hall Brothers Jazz Combo swung into a Dixieland tune that had us all tapping our toes as we left to get ready for the annual symposium the next morning—ably developed by Esther McLaughlin. It was a fine celebration of ten years of our Minnesota Native Plant Society. You may all feel very proud!

• **Old Growth Forest Conservation Alert** - It has been called to our attention that the lumber industry in Minnesota has been lobbying against the designation of stands of old growth forest as Scientific and Natural Areas, a designation that would permanently protect these stands by prohibiting logging and other disruptive activities. The industry also objects to management practices which would protect the old growth forests by establishing buffer zones in which logging activities would be restricted, and which would ensure the protection of future old growth forests by setting aside forest areas which do not yet qualify as old growth (see March Speaker article for criteria) but which will qualify in the near future. It is also possible that these groups will try to complicate the process of designating areas as Scientific and Natural Areas across the board, resulting in fewer SNA designations at a higher cost.

If you are concerned about this issue, let your state legislators know. Without input from you, the voice of the lobbyist may be the only voice your legislators hear. Let them know that you favor:

1. the protection of old growth forest
2. management of resources for future generations, and not merely for short-term profit for a few
3. the designation of sensitive areas as SNAs

Address your letters to:

Representative (or Senator) _____
Minnesota House of Representatives (or Minnesota State Senate)
State Office Building
St. Paul, MN 55155

• **Summer Field Trips - May 16th** - Landscaping with native plants workshop and garden tour at the Maplewood Nature Center. Find out how using native plants in your yard attracts wildlife, decreases maintenance, and can contribute to home energy savings. Douglas Owens-Pike will perform site evaluations and select trees, shrubs and wildflowers. The program will include a slide presentation, practical how-to-tips, and a garden tour. There is a \$10.00 fee for this workshop (due by May 8th) payable to the Maplewood Nature Center, 2659 E. 7th St., Maplewood, MN 55119. The phone number there is 612-738-9383.

May 30th - Search for ramshead orchid and other bog orchids in Mad Dog Lake Bog in southern Cass County (co-sponsored with TNC). Meet at 10:00 AM at Annies Cafe on Main Street (which is highway 5) in Longville. To get to Longville go south on highway 84 from highway 200 about halfway between Walker and Remer. Bring mosquito repellent, a bag lunch and beverage, and binoculars. Wear shoes that can get wet, long sleeves and long pants. Plan to be in the bog 4 to 6 hours. The search area is a large bog, expect to walk at least 2 miles and climb over fallen logs. Trip leader is Donna Sheridan from the Minnesota County Biological Survey.

June 6 & 27th - Habitat survey Crow Wing Bird Banding Station, Emily, MN. Arden Aanestad will lead a group to count canopy, mid-range, and ground cover vegetation at the Crow Wing Banding station. Overnite camping/cabins are available Saturday night. Time: 9:00-12:00. Contact: Arden Aanestad before May 1st for more information at

June 27th - Western fringed prairie orchid search and prairie trip in Polk County (co-sponsored with TNC). Meet at 10:00 AM at Mac's Cafe, 106 Washington Avenue NW, in Fertile. We will visit a known site of Western fringed prairie orchids in the morning and spend the afternoon assisting in the orchid search and mapping project in a nearby area. Participants should bring a bag lunch and beverage, mosquito repellent, a hat and binoculars if you wish. Wear long sleeves over a short-sleeved shirt, long pants and shoes that can get wet. Plan to spend 4 to 6 hours on the trip. The search areas are level prairies. Expect to walk up to 2 miles on level but possibly wet terrain. The trip leader is Nancy Sather from the Minnesota County Biological Survey.

June 27-28 - Spring Beauty & Northern Hardwood Forest. Come enjoy the beauty of spring along the shores of Lake Superior. The trip will include an exploration of an old growth sugar maple

forest and investigation of an old beachfront landscape of ridges and swales. Participants will camp under the starry skies or stay in a room in Grand Marais. Contact: Eileen Jordahl at

July 11th - Theodore Wirth Park, Quaking Bog Restoration and Eloise Butler Wildflower Garden. Meet at the main parking lot for the wildflower garden. Do not leave valuables in your car. Time: 12:00-2:00. Contact: Mary Maguire Lerman at

July 11th - Trip to see the Western Jacob's Ladder, known only to occur in Minnesota and Wisconsin. Meet at 10:00 AM at the DNR Forestry station on county road 5 about 16 miles north of state highway 169 (Co. Rd. 5 intersects Hwy 169 between Hibbing and Chislm). Participants can plan to see the Jacob's Ladder at one of its two known Minnesota sites and spend the afternoon assisting with searches and mapping in a nearby area. Participants should bring a bag lunch and beverage, mosquito repellent (and a net if you have one), a hat and binoculars if you wish. Wear long sleeves, long pants and footgear that protects your ankles and can get wet. The work is in cedar swamps and the going is fairly rough underfoot. Expect to walk 2-4 miles. The trip leader is Roger Lake, DNR Research in St. Paul. Roger can be contacted at

July 18th - Lost Valley Prairie/St. Croix Savanna. 9:00-Noon. Bonnie Harper-Lore will lead a trip to Lost Valley Prairie and the St. Croix Savanna. For more information contact Bonnie at

August 1st - Prairie Landscapes in the Metro Area. 9:00-Noon. Visit several sites in the Twin City area that have used several different methods of establishing native prairie species in the landscapes. Trip leaders are Roy Robison and Bob Jacobson. Contact Roy at or Bob at for more information.

August 8th - Northfield Area Prairie Remnants. Charles Umbanhower will lead a trip to explore the prairie remnants of the Northfield area. Bring a bag lunch. Meeting place to be decided later. Time: 10:00-1:00. Contact: Charles Umbanhower at (evenings). Leave a message.

Sept. 19th - Cedar Creek Natural History Area. Jan Janssen will lead a trip exploring the mosses of Cedar Creek. Bring a bag lunch, rain gear, waterproof boots and a hand lens. Limited to 15 people. Meet at the lab building at Cedar Creek. Time: 9:00-3:00. Contact: Jan Janssen at

Sept. 19th - McKnight Prairie. Mark McKowen and Myles Bakke will lead a trip on the fall wildflowers, grasses and natural history of McKnight Prairie. Time: 1:00-4:00. Contact: Mark McKowen or Myles Bakke at

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- 5) Recall where you have seen the species growing naturally. Or, better yet, take a field trip for that purpose. The Minnesota Native Plant Society has a publication, "Guide to Spring Wildflowers of the Twin Cities Region" by James Schuster and Sandy Hansen that lists nearby natural areas and some of the wildflowers found in each*.

When at the site you will probably have little trouble deciding the general habitat such as deciduous woods, prairie, or north woods (evergreen forest). Also note particularly the mini-habitat, places where one or more of the ecological factors differ. Is it a low spot with a little more moisture? or is it a ridge where wind and drainage are greater? Is the degree of shade more or less than in the surroundings? Companion plants may be important in keeping down some competition and also indicating the acidity or alkalinity of the soil. Nearby rock outcroppings can reveal this also.

- 6) Apply this more precise knowledge to picking the proper spot or for making one for your species. "Openings in woods" may not be available, but the plants could receive a little more sun along paths or at the edge of woods. The Shooting Star, *Dodecatheon meadia*, does well there.

Sometimes there can be a "trade-off". The Cardinal Flower, *Lobelia cardinalis*, is found on wet sand-bars in full sun along the St. Croix river. It will grow in a less moist spot if in partial shade, probably because there its moisture loss is less.

You may not have a wet prairie, but again, a little shade rather than full sun may suffice. The Bottle Gentian, *Gentiana andrewsii*, will grow there but too much shade will keep it from flowering.

Both the Bearberry, *Arctostaphylos uva-ursi*, and the Trailing Arbutus, *Epigaea repens*, grow in sandy acid soil in pine woods. The Bearberry grows at the edge of the woods where it is sunnier and drier, whereas the Arbutus stays among the pines in shadier and more moist conditions.

The American Pasque Flower, *Anemone patens* (or *Pulsatilla nuttalliana*), grows in Minnesota in sunny, sandy, somewhat alkaline areas where there is good drainage. Planting it on a steep south-facing slope helps to insure the necessary drainage.

- 7) Do not be surprised if some species will grow under conditions other than those expected. This could be due to limited observation or to the lack of its natural competitors.
- 8) Keep in mind that mini-habitats can change. The spot that had a fair amount of sun may become too shady because that buckthorn seedling wasn't removed in time. The loss of a tree can make quite a bit of a difference in its immediate surroundings.
- 9) Anything that helps prevent failures conserves not only time and money, but limited wildflower sources. It is well then to study and prepare sites for the native plants before they arrive from the nursery. Several of the Minnesota Native Plant Society members do this very well.

*This booklet can be obtained for \$2.00 by writing to Marcia O'Connor, 2168 W. Hoyt Ave., St. Paul, MN, 55108.

Water Pollination in Minnesota Plants

Charles L. Argue

Part I. Surface Pollination

Although the flowers of the overwhelming majority of aquatic angiosperms are adapted to aerial pollination, a few have come to utilize water rather than animal vectors or wind currents as the agent of pollen transport. These so called hydrophilous plants are capable of dispersing their pollen either on or beneath the surface of the water, depending on the species.

Dispersal directly on the surface of the water (surface hydrophily) is relatively rare and is often considered transitional between wind pollination and submerged, or true, hydrophily. It occurs in Minnesota in the waterweeds (*Elodea canadensis* and *nuttallii*) and in some pondweeds (*Potamogeton*). The Canada waterweed (*Elodea canadensis*), a gregarious and widely distributed plant in Minnesota, bears its functionally male and female flowers on different plants. Male plants, however, are uncommon, and the frequency of seed production remains to be determined. Both the male and female flowers open at the water surface. They reach the surface dry on an elongated hypanthium, protected by a narrow, closed, biserriate perianth tube. The male flowers open suddenly: three water-repellant outer perianth segments reflex against the surface film and hold the 9 stamens erect. Anther dehiscence is explosive, and pollen is scattered over the water surrounding the flower. The pollen grains are joined in groups of four and are densely ornamented with small, air-trapping spines, which maintain the body of the pollen grain above the water surface, allowing for easy movement over the surface film. Initially, the pollen may spread like oil droplets due to an outer coating of oily material. Slight breezes or other disturbances disperse the pollen grains, some of which come into contact with the female flowers. These lie obliquely in small depressions of the surface film. The three water-repellant stigmas extend beyond the margins of the perianth and two usually contact the water surface. Pollen grains that pass close to the female flowers are "captured" in the depressions by gravity and contact the stigma bringing about pollination. The single uniloculate ovule contains three or four ovules, and retention of the pollen in groups of four, only two of which usually germinate, may promote fertilization of more than one ovule even if only one pollen unit locates the female flower.

Elodea nuttallii, also well represented in Minnesota, provides an interesting variation. It is the only known *Elodea* among some 10-12 species World-wide in which the male flower is normally detached from the parent plant. These flowers are thus able to drift freely prior to dehiscence, and it has been conjectured that this increased mobility may enhance the chances of a successful pollination. Except for the absence of petals in the male flower, both the male and female flowers closely resemble those of *E. canadensis* in structure and behavior.

Pollination in *Elodea* differs from the frequently described sequence in *Valisneria*, where the pollen does not touch the water. *Elodea* and *Valisneria* are related, and pollen dispersal in the former represents a clear specialization in the direction of hydrophily.

Surface hydrophily has also been reported in two Minnesota species of pondweed (*Potamogeton*), a genus in which most species have wind pollinated, protogynous flowers. The flower spikes of *P. filiformis* and *P. pectinatus* are lax and floating. Pollen is transported on the surface film to the stigmas, said to have larger receptive papillae than wind pollinated taxa. Pollen of these species is also reported to tolerate wetting much better than that of wind pollinated species. Pollination of the same or other inflorescences can occur. However, the need for further study is suggested by reports of seed set in plants of *P. pectinatus* growing in deep

water without the spikes reaching the surface. The flowers of two other Minnesota species, *P. pusillus* and *P. berchtoldii*, resemble those of *P. pectinatus*. Their small, few-flowered spikes project only a short distance above the surface, and their pollination biology needs investigation to be continued.

Part 2. Underwater Pollination

Minnesota taxa exhibiting submerged pollination (true hydrophily) include species of *Ceratophyllum*, *Zanichellia*, *Najas*, and *Callitriche*.

The familiar hornwort (*Ceratophyllum demersum*) is rootless and usually free-floating. Small flowers are formed under water and are either male or female, with a single male or female flower present at different nodes or leaf whorls on the same plant. Male flowers are comprised of a fascicle of 10 to 20 stamens surrounded by a cup-shaped involucre of bracts. Female flowers contain a single carpel with a slender tapering style and elongated bifid stigmas surrounded by an involucre similar to that found in the male flowers. As the stamens mature they break off one-by-one and rise to the surface, buoyed by an expanded, broad-tipped connective. At the surface the anthers burst open and release very thin walled, nonaperturate pollen grains which sink slowly down through the water around the female flowers. This process is notable in that the anthers dehisce in the air, and the pollen subsequently returns to the water. Such a large number of pollen grains are released that they can cloud the water around the female flowers. Pollen that is caught on the stigmas will germinate and fertilize the single ovule in each carpel.

Like the hornwort, the flowers of the horned pondweed (*Zanichellia palustris*) are pollinated under water, but unlike the hornwort, their anthers also dehisce under water. Flower clusters occur in the leaf axils, with both male and female flowers in each cluster. The female flowers have been variously interpreted, but according to many authors, consist of a cup-shaped spathe surrounding several carpels, each a separate and reduced female flower with one ovule and a peltate stigma. The male flower is reduced to a single stamen with a long filament elevating the anther above the carpels. Pollen is thin walled and nonaperturate. When released it sinks slowly onto the stigmas of the same or a neighboring inflorescence, in either case sliding down the stylar canals where it germinates to fertilize the female flowers.

Pollen tubes develop precociously in some species of horned pondweed, and this also occurs in two species of Minnesota naiads, the slender naiad (*Najas flexilis*) and the large naiad (*N. marina*). Both species are annuals, an unusual circumstance among aquatics. The male flower is reduced to a single sessile anther surrounded by a sac-like perianth. The female flower is a solitary ovary terminated by a style and 2 or 3 stigmas. In *N. flexilis* both male and female flowers occur on the same plant, whereas in *N. mariana* they are borne on separate plants. The pollination of *Najas* has yet to be studied in detail. The pollen lacks an outer wall, and its germination prior to release produces an elongated structure. This shape, found in the ungerminated pollen of some other hydrophilous plants and in fungal spores among several aquatic Hymenocetes, is thought to increase the probability of the slowly sinking pollen being captured on the elongated stigmas.

The water starworts (genus *Callitriche*) include terrestrial and amphibious species that are probably normally wind pollinated. However, submerged species of section *P. sudocallitriche*, including *C. hermaphrodita* in Minnesota, produce flowers and fruits underwater. The flowers are much reduced with male and female flowers usually solitary in the leaf axils and regions of male and female flowers sometimes alternating along the stems. The male flower consists of a single anther on a short filament. The female flower is reduced to a single pistil with two long and reflexed free styles, papillose along their entire length, and a 4-locular ovary, each locule with a

single ovule. The pollen grains, released under water, have a thin, undifferentiated wall and contain many oil droplets. The oil droplets reduce the specific gravity of the pollen grains, allowing them to remain suspended in the water as they are carried about at all depths by currents, eventually in some cases reaching and adhering to the stigmatic papillae. The thin walls, as in other hydrophytes, represent an energy conservation measure, thick walls not being needed to prevent desiccation.

Another Minnesota species deserving careful study is the western ditch grass or widgeon grass (*Ruppia occidentalis*). A related species, *R. maritima*, is sometimes reported to have submerged hydrophily, whereas other authors say pollination in all species takes place at the water surface and involves floating pollen. The pollination of *R. occidentalis* is currently under study in central Minnesota. Along with the absence of bright colors, scent, and nectar, many characteristics of hydrophilous plants are also common in wind pollinated species. The flowers are frequently unisexual with a tendency to separation of the sexes on different plants, as in *Elodea* and *Najas marina*. They have a reduced perianth, the stigmas are large, ovule number is reduced, often to one, and a relatively large number of pollen grains are produced for each ovule available for fertilization; fewer are produced in surface hydrophily, which occurs in two dimensional space, than in subsurface hydrophily or wind pollination. Reductional tendencies can be traced within many groups. For example, a series for taxa within the Najadales suggests a trend from bisexual to unisexual flowers, reduction and loss of the perianth, and reduction in stamen number from *Potamogeton* through *Ruppia* to *Zanichellia*.

Other characteristics, such as the absence of plumose stigmas and pollen grains that are thin walled and often somewhat elongated or that germinate precociously or include oil droplets reflect the difference in character and density of the transporting medium.

Much additional work is needed before the reproductive biology of hydrophilous plants can be fully described. It is likely that additional pollination mechanisms will be discovered, and studies of sexual compatibility, apomixis, mate choice etc. are not yet available. Hydrophily is often viewed as something of an oddity. Rather than merely unusual, however, this form of sexual reproduction provides a case dependent guide to the interplay of unusual and extreme selective pressures on the evolution of a variety of specialized reproductive programs, many of which remain to be examined in detail.

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Summary of Guest Presentations at MNPS Monthly Meetings (February - April, 1992)

February 5, 1992 - Plant-of-the-Month: Welby Smith, Minnesota DNR Botanist, focused on the orchid genus *Malaxis* which has the smallest flowers of any orchid. There are 3 species in Minnesota. *M. unifolia* (Green Adder's-Mouth) has a single leaf in the middle of the stem. Most of the flowers of this orchid are clustered at the top of the stem. There are up to 50 tiny flowers in the inflorescence. It grows primarily in bogs in the timbered area of the state but can be found in upland sites in sandy jack pine forests.

M. brachypoda (White Adder's-Mouth) is very rare. It has an elongated flowering stalk or spike and one leaf.

M. paludosa (Bog Adder's-Mouth) is the rarest orchid in North America. It is 4.5 inches tall and has a single stem leaf and 2 - 4 basal leaves. It also has the smallest flower of any orchid in N. America. The fungus gnat is the only insect known to pollinate this flower. The only time this insect has been seen in North America was on a Bog Adder's-Mouth. So it's a rare insect, as well! Although many orchids in Minnesota are pollinated by mosquitoes, these insects step over the tiny flowers of Bog Adder's-Mouth like they weren't even there. The leaves of this orchid produce tiny foliar embryos or vegetative propagules at their tips. These propagules fall off when they mature. There are 3 extant and 2 extinct sites for this plant in north central Minnesota.

Our main February speaker was Diane Plunkett, former president of the Minnesota Nature Photo Club. Diane began by reminiscing about the first MNPS meeting in 1982. It was -14F with a wind chill of -27F and 76 inches of snow were on the ground. Evelyn Moyle gave a talk that night about Minnesota wild flowers which must have been greatly appreciated by the shivering audience.

For her presentation, Diane provided us with a list of Minnesota orchids and referenced some books about orchids including *Orchids of the Western Great Lakes Region* by Fred Case. She also reminded us that virtually all orchids purchased from a nursery are taken from the wild. Orchids are almost impossible to grow from seed. One of the reasons they are so difficult to grow and establish is that they are dependent on a symbiotic relationship with soil fungi called mycorrhizal fungi. She suggested that orchids should never be moved from their habitat unless the area is to be destroyed by construction or development.

Hawaii has only 3 native orchids, Alaska 36 and Minnesota has 45 native orchids. Of these, Diane showed us many beautiful slides of orchid blooms and some of the dried seed pods. Her slides included: putty root, dragon's mouth, grass pink, calypso orchid, bracted orchid, spotted coral root, striped coral root, northern coral root, pink lady slipper, ram's head lady slipper (the smallest lady slipper), large yellow lady slipper, small yellow lady slipper, small white lady slipper, showy lady slipper (our state flower), downy rattlesnake plantain, lesser rattlesnake plantain, tall white bog orchid, tall green orchid, small purple fringed orchid, large round leaved orchid, large tway blade, lesser tway blade, heart leaved tway blade, small round leaved orchid, showy orchis, rose pogonia, and lady's tresses.

Diane's presentation was light, bright and humorous. As a finale, she gathered the MNPS charter members in attendance and took their picture for posterity (shown on next page).



From left, back row: Welby Smith, Dr. Gerald Ownbey, John Masengarb & Dianne Plunkett. Front row: May Wright, Evelyn Moyle & Chris Soutter.

March 4, 1992 - Our March speaker was Bob Djupstrom, from the Minnesota DNR's Scientific and Natural Areas (SNA) Program. He discussed the history, current status, and future goals of the SNA Program in Minnesota. A summary of his remarks follow.

Scientific and Natural Areas enjoy the highest degree of protection of any state-owned lands. The program was established by legislation in 1969, and the first land was set aside in 1972. SNAs are set aside primarily to protect the resource, and can be used for scientific research, as well as for nature observation, interpretation and photography. Hunting, trapping, camping, picnicking, logging, and other potentially disruptive activities are generally prohibited in SNAs.

SNAs are set aside to protect distinctive natural elements, including rare plants, plant communities, geological features, and peat landforms. Before 1979, these areas were identified by nomination of an advisory committee and the public. Since 1979, there has been heavy reliance on the Minnesota Natural Heritage Program's database for rare element identification.

There are currently 92 SNAs, consisting of 164,000 acres. Over 146,000 of these acres were added to the SNA program by the recent peatland legislation. It is estimated that Minnesota will need 500 natural areas to protect multiple examples of rare features within the various regions of the state: 200 in the prairie biome, 135 in the deciduous forest biome and 165 in the coniferous forest biome. In 1985, meeting this need was identified as the 100 year goal for the SNA program.

There are many obstacles to protecting the areas that will need to be set aside if these goals are to be met. On the average, approximately \$200,000 per year has been available in the past for land acquisition, but especially in the urban areas, a single site may cost more than this. Because of the level of protection, interests such as the lumber industry are opposed to SNA designation. Old growth forest, for example, is defined as forest that has been undisturbed for at least 120 years, and which is dominated by long-lived tree species. There is very little of this type of forest left in Minnesota: most old-growth red and white pine is located within the boundaries of Itasca State Park. Lobbying by the lumber industry is currently aimed at SNAs so that these large trees can be harvested. One strategy currently being pursued by lobbyists is to complicate and restrict the entire SNA designation process, thereby preventing many other natural elements from being

protected as well. The SNA Program purpose is to preserve and protect Minnesota's rare and endangered resources for future generations.

April 1, 1992 - Plant-of-the-Month: Barb Delaney, Plant Ecologist with the Minnesota Natural Heritage Program, increased our knowledge and appreciation of Minnesota's state flower, the showy lady slipper, *Cypripedium reginae*. Barb's presentation was based on the 1943 paper published in the American Journal of Botany by John T. Curtis describing seedling development of the showy lady slipper.

From seeds that are less than 1 mm long, the seedling grows only 5 mm the first year after germination. After 4 years, the leaves of the orchid seedling are only about 5 cm long. Reproductive maturity is attained only after 14 to 16 years. Even though the seed capsule from a single flower may contain 10,000 to 30,000 seeds, very few reach maturity. Curtis found that seedlings greater than four years old were extremely rare. Growing and propagating these plants is extremely difficult. The showy lady slipper is dependent upon its association with endotrophic fungi called mycorrhizae. These fungi dissolve organic matter in the soil releasing the nutrients which are in turn utilized by the orchids.

Curtis stated in his classic paper that little is known about the natural conditions under which the showy lady slipper thrives. Much needs to be learned in order for us to properly manage the habitat which supports these orchids and if necessary in the future, to resort to artificial propagation. These fragile and sensitive plants should not be removed from their habitat.

Our main speaker was Jan Jansson titled his talk, "Minnesota Mosses." Mosses are placed in the group of plants called "Bryophytes." Although they are typically referred to as non-vascular plants, some of the more primitive mosses have vestigial vascular tissues. These tissues are made up of hydroid cells which act like the xylem in "classical" vascular plants. Mosses that do not have such tissues have a more simple structure and are therefore more evolutionarily advanced.

The mosses have two distinct visible generations in their life cycle: the gametophyte (1N or haploid) is the green leafy stage that we associate with the familiar mats and carpets of mosses. The sporophyte stage (2N or diploid) grows attached to and is parasitic on the gametophyte. The sporophyte is the result of sexual reproduction; the joining of an egg and sperm (or gametes) produced by the gametophyte. The egg is formed in the female reproductive structure called the archegonium. The sperm is formed in the male reproductive structure, the antheridium. Usually water (dew or rain) carries the sperm to the egg. When the sporophyte matures, it forms a capsule in which spores are produced. Upon release from the capsule, the spores that land on a suitable substrate germinate and grow into the gametophyte. And so it goes, 'round and 'round!

There are many different growth forms among the various species of moss. The growth form is closely related to the habitat in which a particular species of moss grows. "Tufts" have a more upright structure and are found on fairly stable substrate. "Mats" branch profusely, are a flatter form and are tightly adhered to the substrate. "Carpets" are a lawn of upright plants with spreading branches. Sphagnum moss is an example of a carpet forming growth form. "Wefts" are like mats and have profuse branches, but they are easily separated from the substrate on which they grow. They are not in contact with the soil but are draped over it. They obtain nutrients from the leachate dripping from the trees overhead.

Less common growth forms are "dendroid", "aquatic", "epiphyte", and those that grow on dung. "Dendroid" forms look like a little tree. They have a subterranean rhizoid or root-like structure and an upright stalk on which there are bunches of secondary branches. "Aquatic"

growth forms grow in water. Epiphytes are common in the tropics and on the west coast where they can be found forming big balls and masses on Sitka spruce. Those forms of mosses that grow on dung are very specific (i.e. one moss only grows on moose dung and another will only grow on owl pellets). These have co-evolved with the specific dung and some produce a smell like the dung which attracts insects which in turn ensure propagation of the moss.

Sphagnum moss is an important moss in Minnesota. It is the primary moss that forms the vast peatlands of our state. Its apical cell or growing point is indeterminate. In other words, the older parts of the plant can die and the tip continues to grow. Because of the acidic conditions in which this plant lives, the dead parts of the plant do not decay. Consequently, large hummocks are formed. Some of these hummocks are about 1,000 years old.

Sphagnum and the peat it forms store more carbon than any other plant. Because of the ability to lock up carbon the peatlands are as important as tropical rain forests in slowing global warming.

Other Activities & News

The Nature Printing Workshop - August 23-28, 1992, Hackensack, MN. The Nature Printing Society has 125 members, ranging from professional Gytaku artists in Japan to a man in Germany who has the worlds largest private collection of historical nature prints. The NPS workshop will be held at Deep Portage in Hackensack, MN, August 23-28. The workshop is limited to 50. Reservations will be accepted on a first come, first serve basis, with a deposit due in April. Cost will be approximately.. \$375.00. For more information, contact:

Sonja Larsen

White Pine Symposium September 16-18, 1992 - History, Ecology, Policy and Management Duluth, MN (Duluth Entertainment Center-DECC). The symposium will deal with the white pine as a tree, an ecotype, an economic resource and an aesthetic resource. The audience will be natural resource professionals, researchers, policy makers, and some special interest groups. People are invited to display poster or exhibits at the symposium. If you have any questions, please call Steve Simmer at

Lyndale Park Gardeners Open House June 20, 1992 from 11-2:00 PM. Lyndale Park Rock Garden, northeast shore of Lake Harriet. An event to acquaint gardeners with the various plant societies, garden clubs and related organizations that are available in the metropolitan area. The Hennepin County Master Gardener Mobile Horticulture Center will also be participating that day and be on hand to help answer gardeners questions about their plants and possible pest problems.

Ozone May Be Slowing the Growth Of Aspen

Dr. Richard Dickson and Jay Hutchinson (612) 649-5275

February 20, 1992. As the amount of ozone in the atmosphere increases, the rate at which aspen trees grow declines, according to scientists at the Forest Service's North Central Forest Experiment Station, in Rhinelander, Wisconsin.

Scientists at the School of Forestry and Wood Products, Michigan Technological University, and Forestry Sciences Laboratory, Rhinelander, found that individual aspen trees respond differently to ozone stress. One surprising finding of their research is that the greater the average ozone concentration at localities where aspens were collected for the study, the less the injury caused by the ozone, although climate plays a role as well. This finding supports the hypothesis that the levels of ozone may be eliminating ozone-sensitive aspen from forests, causing the species to undergo natural selection for ozone tolerance in several locations across the country.

The Environmental Protection Agency will use the research results to determine if ozone pollution standards are acceptable for forest health. The research also helps explain current damage in aspen forests and will help scientist predict what the future response of forests will be in th event of global warming and increasing ozone pollution. For more information contact:

FOREST SERVICE NEWS
North Central Forest Experiment Station
1992 Folwell Avenue
St. Paul, MN 55108

Note From The Editor - My apologies for the tardiness of the newsletter, things just kept coming in the mail and I didn't seem to be able to say no to putting them into the "Press". I also ran into a number of computer difficulties and the field season started at work, keeping me away from my computer and printing facilities.

Have a great summer!!!

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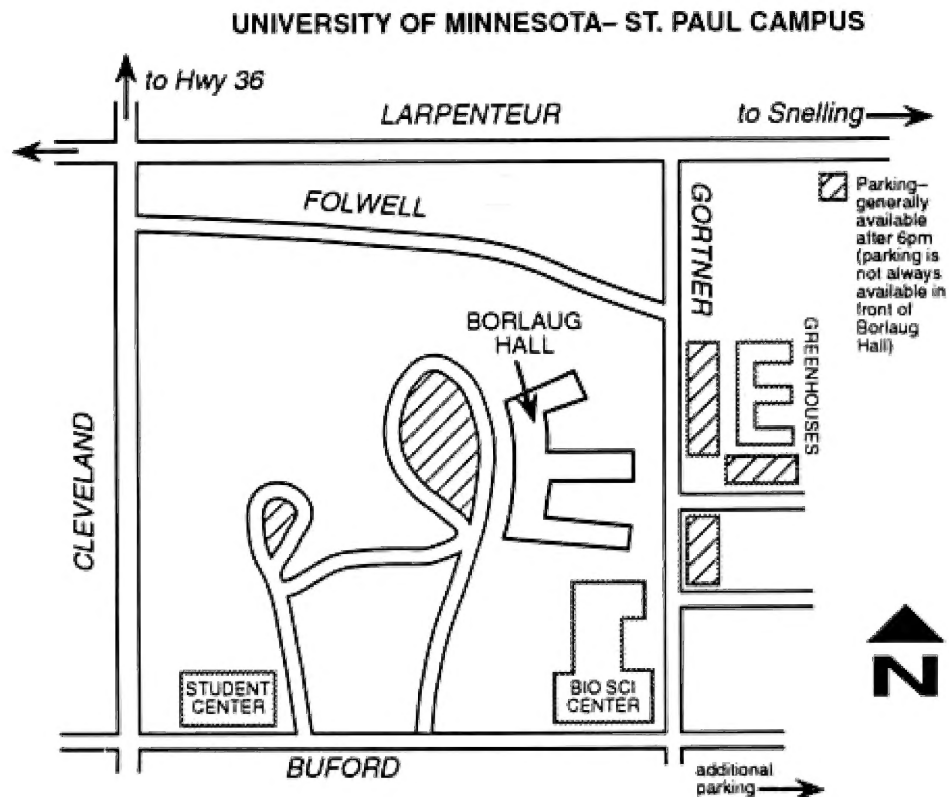
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